ESA-090 Final Public Report

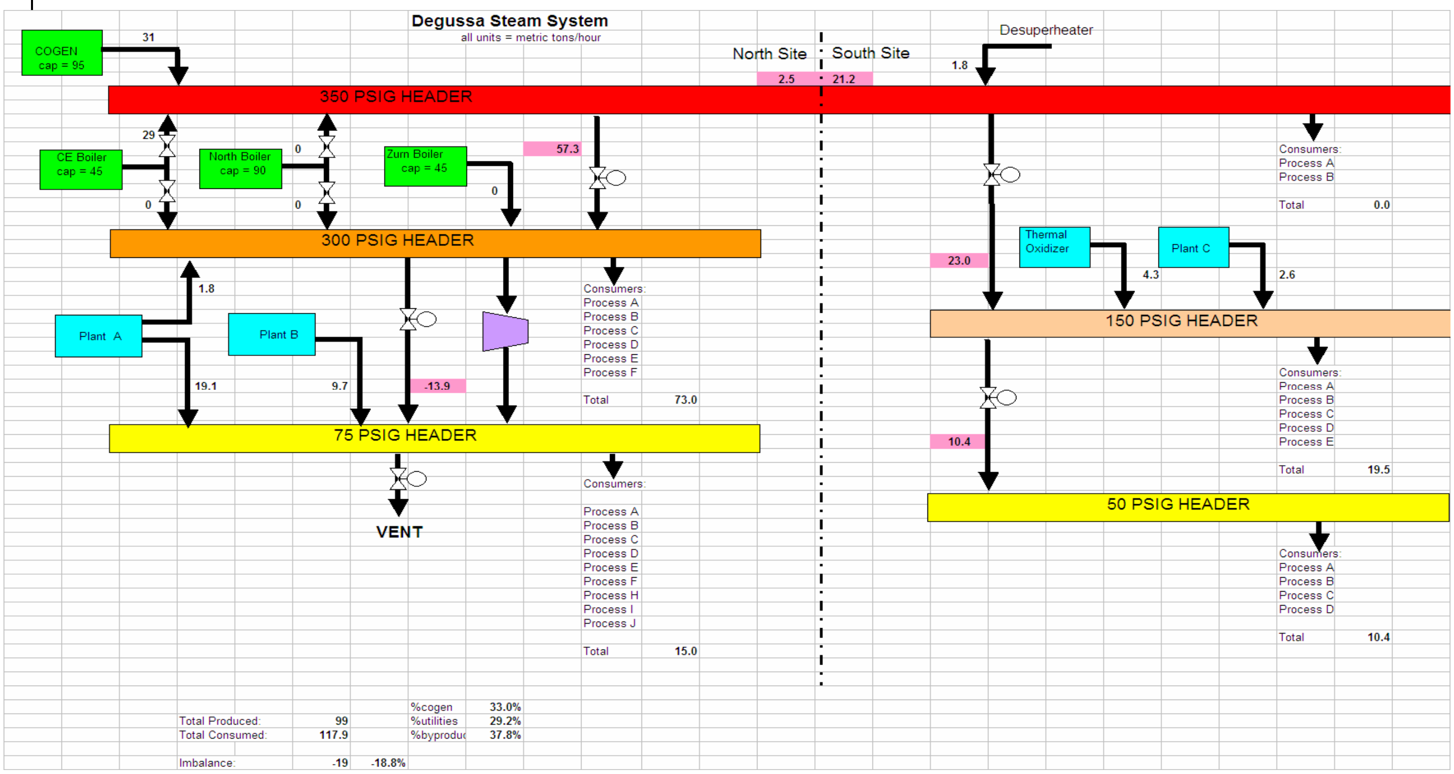
Introduction:

The Degussa Chemical plant in Mobile, Alabama, actually consists of two contiguous production facilities. Electricity is provided to the plant by the local utility, Alabama Power Company. The cost of electricity is approximately $0.045/kWh. Utility feeds enter main service substations at both plants. Based on monthly breakdowns of power consumption provided by Utilities Group staff, the average power consumption level is approximately 33 MW. All but about 5 MW are consumed on the North Side.

The company has experienced the impact of natural gas cost increases and fluctuations that occurred in 2005 and 2006. Natural gas is currently supplied by Atmos Energy, Eagle Energy Partners and Mobile Gas Service Corporation.

The steam system configuration is indicated in the schematic diagram below.

Degussa Chemicals Steam System



Source: Degussa Chemicals

The steam plant is located on the North Site, and consists of two operational water-tube boilers. One is manufactured by Combustion Engineering (CE boiler), and has a rated output capacity of 45 Metric Tons/hr (100 k Pounds per hour-PPH). Another unit, identified as the "Zurn Boiler," has a rated output capacity of 40 Metric tons/hr (202 kPPH) is also used, and a third boiler, exists but is not used.

The CE boiler is the base-load unit. While natural gas is the principal purchased fuel for all boilers, one of the functions of the CE boiler is to burn by-product hydrogen produced on site. A typical steam output level for the CE Boiler is +/- 59,000 PPH (24.5 Metric Tons). Much of the balance of both the North and South Side steam loads are met by imported steam from the cogeneration plant. Based on a review of 2005 monthly bills, the cogeneration plant, on average, provides 65 kPPH (29 Metric Tons).

Steam is imported from a combined cycle cogeneration plant adjacent to the North Side to a high pressure header at 350 psig, 737 deg. F (superheated), which serves both plants. At the North Side, steam is then throttled to a medium pressure header (also served by CE and North Boiler) at 300 PSIG and finally a low pressure header at 75 PSIG. South side steam is reduced to a 150 PSIG medium pressure header and a 50 PSIG low pressure header.

Additional heat is recovered from some process units, and steam is supplied into the headers as available from these units. Boiler plant conditions are observed 4 times per eight-hour shift, and average conditions are recorded and stored in monthly reports. Make-up water is not logged. Blow-downs are conducted routinely.

No steam leaks were observed, and insulation condition is very good. Valve bodies and ancillary devices are typically insulated with appropriate jackets.

The condition of steam traps on the Utility Mains was assessed within the last year. However, the management of the steam system within the various process plants is left to personnel responsible for those units. The conditions and practices in these areas are not documented.

Focus of Assessment:

The focus of the Assessment was on strategies to reduce natural gas use by steam system efficiency improvements. Steam is used in a variety of chemical production processes.

Approach for ESA:

The approach included the following:

1. Analysis of Steam Systems and Sources
    - -Monthly Reports
    - -Recent Studies
    - -Alabama Power Cogeneration Steam Contract and Bills
2. Field Survey
3. Discussions with Personnel
4. Identification of Opportunities
5. Analysis

General Observations of Potential Opportunities:

Annual energy consumption at the plant from the ESA Application is listed below. However natural gas use includes significant process consumption in addition to steam generation.

- Imported electricity: 293,000,000 kWh (1,000,000 MBTUs)
- Natural Gas: 3,000,000 MBTUs
- Other fuels (byproduct Hydrogen): 289 MBTUs

The estimate of byproduct hydrogen used as boiler fuel is from information obtained during the ESA.

The principal item of interest that motivated the request for the ESA was to compare the cost of steam available from three sources: the adjacent cogeneration plant, the site boilers, and steam recovered from process. It was determined that some benefits occur from prioritizing cogeneration steam due to favorable contract terms. However, there are limitations on the amount of steam that can be imported due to the requirement to burn by-product hydrogen in an on-site boiler.

All results are based on SSAT results. Where appropriate and to reflect the fact that steam is supplied from both the on-site boiler and the cogeneration plant—for which Degussa does not incur an efficiency penalty, the composite efficiency value reflects an average of the efficiency associated with the two sources.

Energy Conservation Opportunities:

Energy Conservation Opportunities identified are listed below. Two of the near term measures address steam system operations and management practices.

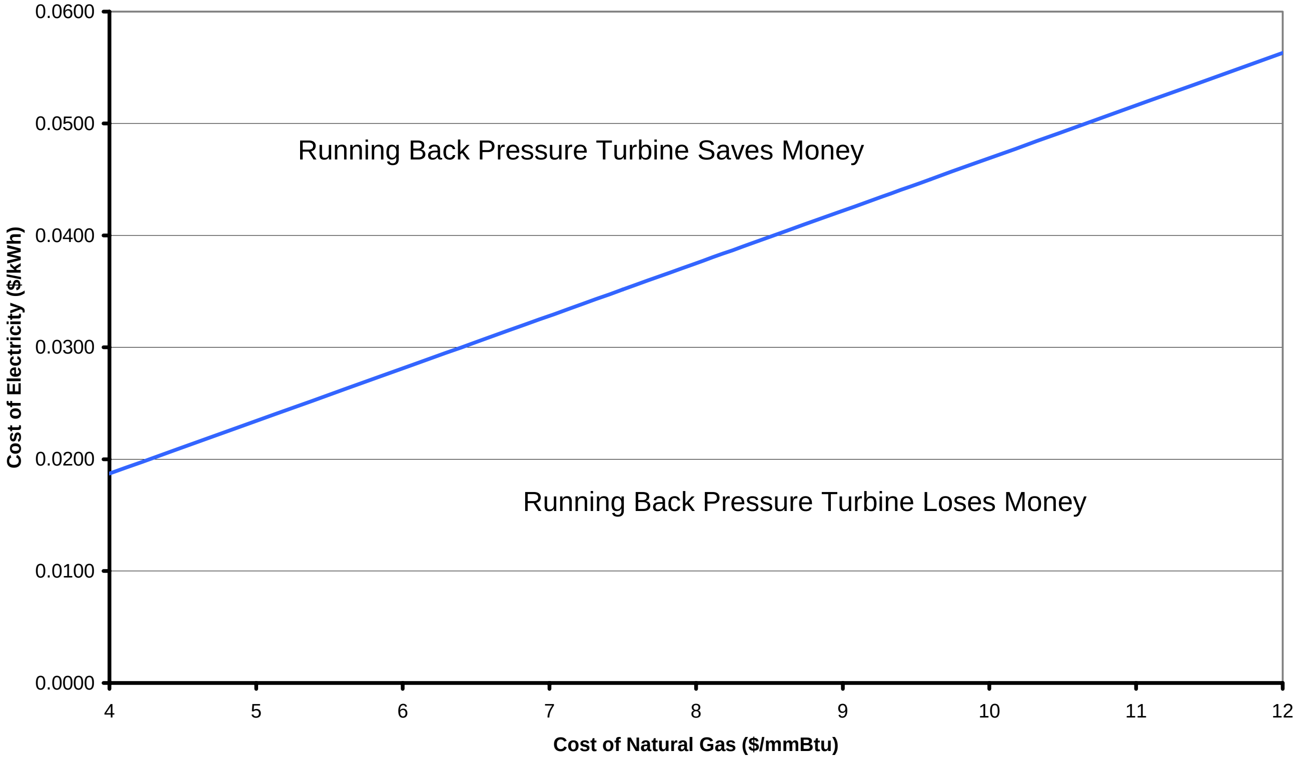
Near Term

- Improved Steam Trap Maintenance/Steam Leak Maintenance—these SSAT projects were used to estimate the benefit from instituting a Site-wide Approach to Energy Conservation; i.e., the Creation of a management entity with participation by the Utilities Group as well as the Process Unit personnel is needed to emphasize energy conservation awareness and assure that uniform practices for items such as benchmarking, steam trap maintenance, steam leak repair, and insulation installation and maintenance are in place. Savings from this low cost measure are conservatively estimated to be $73,000 per year at a gas cost of $7.50 per MBtu.
- Change Condensate Return (Condensate Return from South Site) – Constructing a condensate return system from the South Site, using the Steam System Assessment Tool, was estimated to save $215,000 per year at $7.50 MBTU. The cost of this measure is believed to be in the range of $600,000 to $1,000,000.
- Change Boiler Efficiency (Combustion Engineering Boiler Efficiency Improvement) – This unit is operated with high excess air levels due to the variation in hydrogen content of the fuel mix. This is likely contributing to accelerated stack corrosion. The feasibility of installing a compressor and tank for compressed hydrogen storage to allow for uniform mixing of the fuel streams, and better combustion control and efficiency which was investigated. However, suppliers of tanks and compressors to handle the flow levels and capacities needed (average of 168 kg/hour) are limited and a basis for estimating a cost for this measure could not be developed. If implemented, this measure is estimated to result in savings of $151,000 per annum at $7.50/mmBtu. The scope of work should include burner changes recommended by Furnace and Tube Service, Inc. in their recent report. During follow up conversations with them, they believe that much of the needed improvement in burner control can be accomplished by this work, which is estimated to cost less than $100,000.

Mid-Long Term

- Reduce Steam Demand by Changing Process Steam Requirements – During discussions with Utilities Group personnel, the design or operating basis for the header supply conditions, especially the relatively high superheat temperature could not be explained. It was speculated that the superheat condition is intended to assure that dry steam is delivered to the processes. If this is the case, reducing the output temperature of the steam of the Boiler/Cogeneration Plants from 730 F to 550 F would introduce a savings potential of $818,000/yr at $7.50/mmBtu. However, if the total heat per pound of steam available is the controlling criterion to meet the needs of one or more Plant units, reducing the superheat level will result in an increase in cost. An assessment of the process requirements for steam conditions should be undertaken in the near future, possibly as a task undertaken by Site-Wide entity recommended above.
- Change Boiler Efficiency (Replacement of the CE Boiler)—replacement of this unit with a new appropriately-sized boiler designed for hydrogen and natural gas combustion was evaluated. The design output of the replacement unit will be significantly lower than the existing boiler. While this measure was shown to result in greater savings than the efficiency improvement measure, the estimated savings is $217,000 per year, while the cost of a smaller capacity boiler is estimated to cost $1 million to $1.5 million.
- Add or Modify Back-pressure Turbine Operation (medium to low pressure headers)—a backpressure turbine generator driving an 800 Hp cooling tower motor is not operational due to reduced steam flows currently in effect. An analysis of appropriate conditions (natural gas and electricity cost) under which to utilize this unit should be developed and used to guide operational practices. Options for supplying the needed steam quantity (14 MT) should also be identified and evaluated. Using the SSAT, parameters for which it is cost effective to utilize the back-pressure turbine were determined and are provided in the graph below.

Parameters for Using Back Pressure Turbine to Generate Electricity



Management Support and Comments:

The current cost of gas of approximately $7.50/MBTU poses a significant operating cost penalty on the Mobile operation, which has contributed to production being shifted to facilities located outside of North America where gas costs are lower. As a result there is strong interest in reducing natural gas cost.

Response to Survey on Energy practices is pending.

DOE Contact at Plant/Company: Same as corporate Lead.